

(12) **UK Patent Application** (19) **GB** (11) **2 207 075 A** (13)  
(43) Application published 25 Jan 1989

(21) Application No 8816046

(22) Date of filing 6 Jul 1988

(30) Priority data

(31) 40086

(32) 10 Jul 1987

(33) IT

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(51) INT CL\*

B26F 1/38 D06B 1/08

(52) Domestic classification (Edition J):

B4B 29A

D1L 10X

U1S 1600 B4B D1L

(56) Documents cited

None

(58) Field of search

B4B

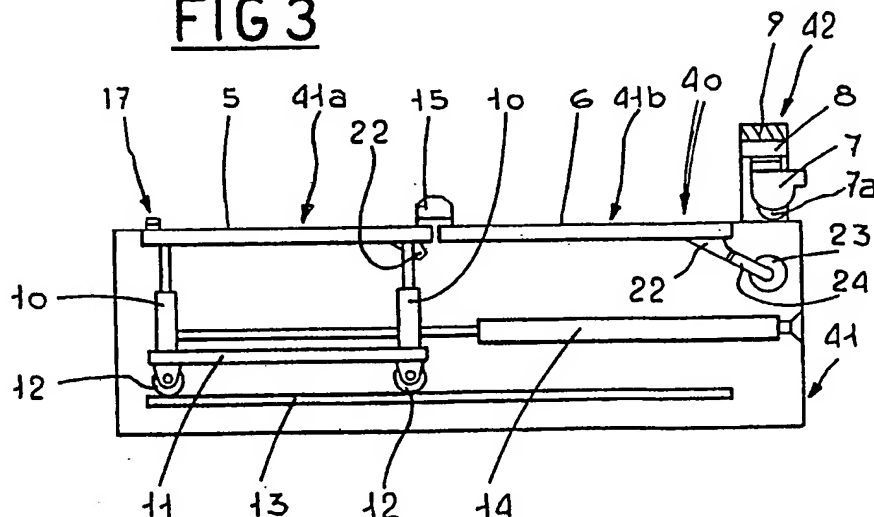
Selected US specifications from IPC sub-classes

B26F B26D

(54) Automatic machine to steam and cut knitted cloths

(57) The machine is provided with two cloth supporting tables 5, 6 movable on a supporting frame 41 so that each can be positioned in either a laying out area 41a or a cutting out area 41b. Table 5 can be lowered, e.g. by fluid cylinders 10 and moved lengthwise by e.g. a fluid cylinder 14, the table 6 being simply slid lengthwise. Laying out can thus take place in area 41a whilst cutting out is executed in area 41b by a rotary disc 7a supported for rotation about a vertical axis by a carriage 7 movable transversely to the corresponding cloth table, along a bridge 9 in turn longitudinally movable with respect to said cloth tables. The movements of the bridge, the carriage and the shears are controlled by a control unit provided with a self-learning software so that a first manually-guided cutting-out operation can subsequently be reproduced automatically. Exhaust means 22, 23 are associated with the cutter 7 and a steam distributor 15 spanning the tables is movable lengthwise of area 41b.

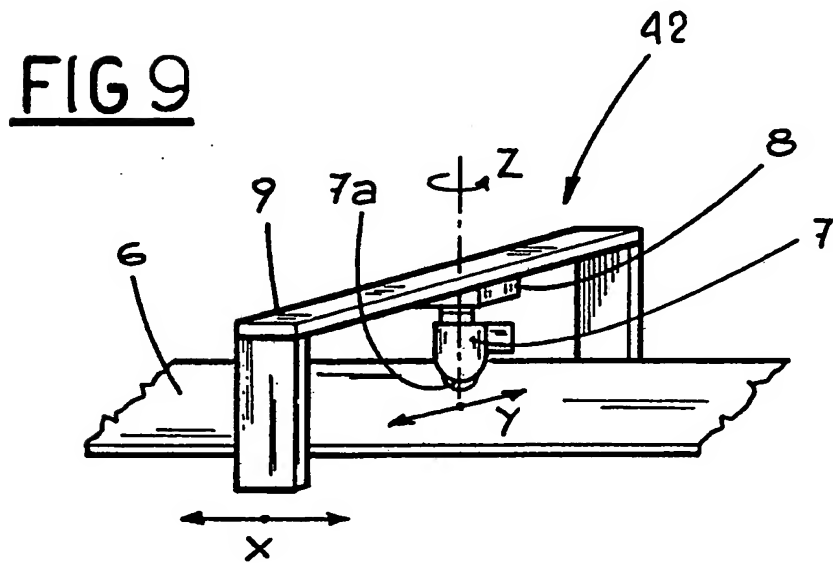
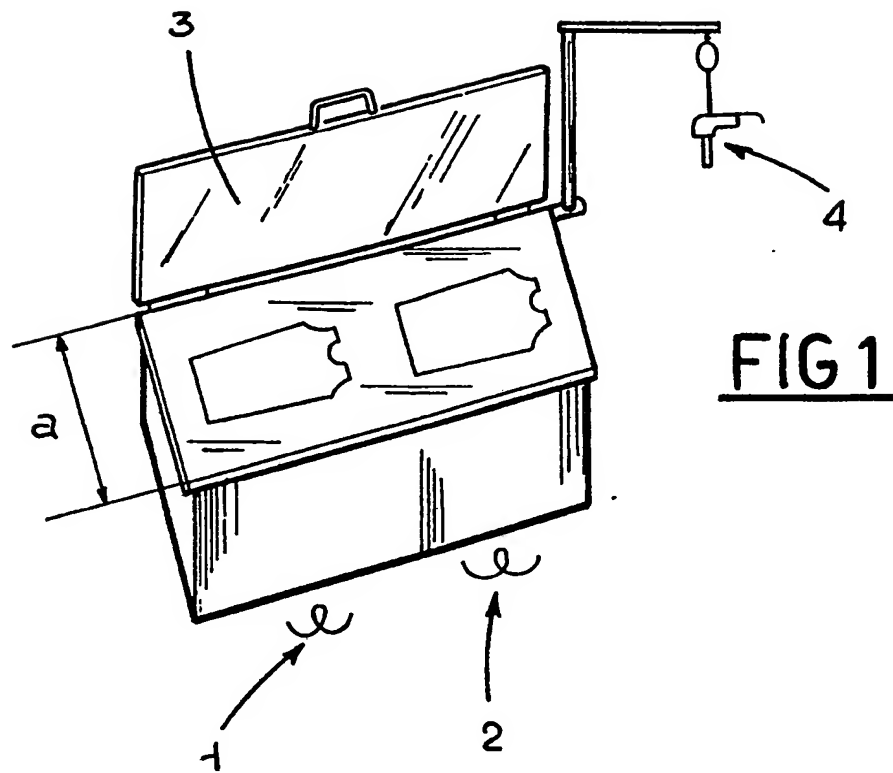
**FIG 3**



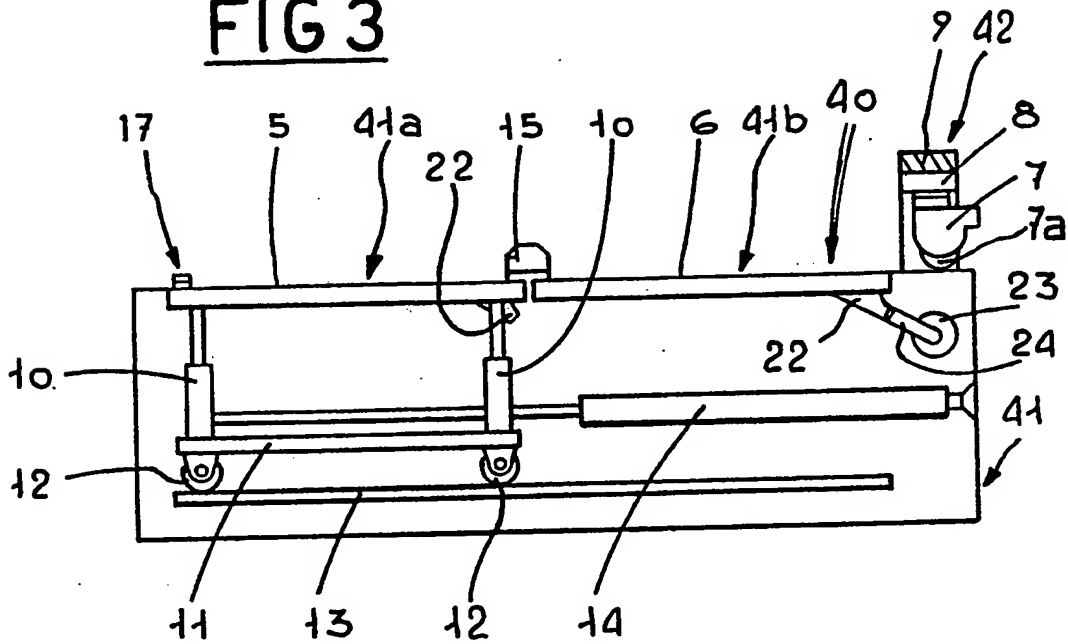
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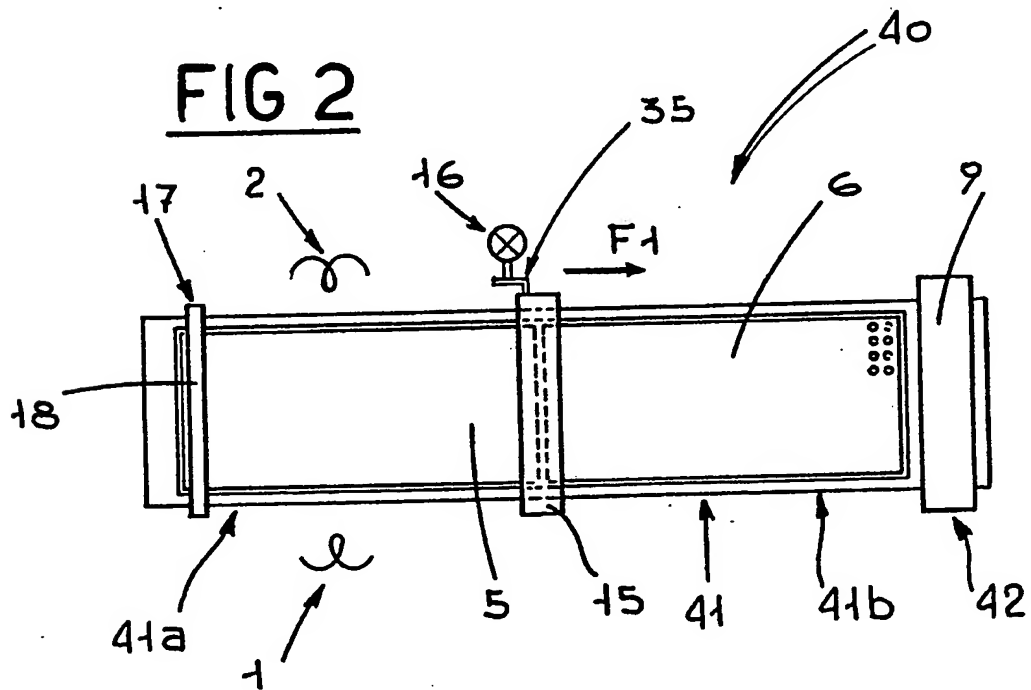
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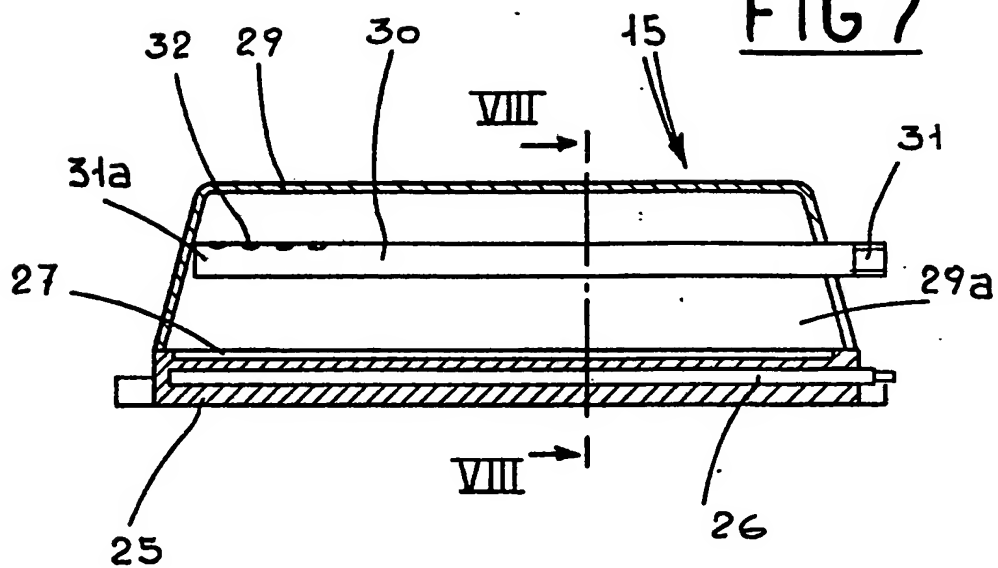
**FIG 3**



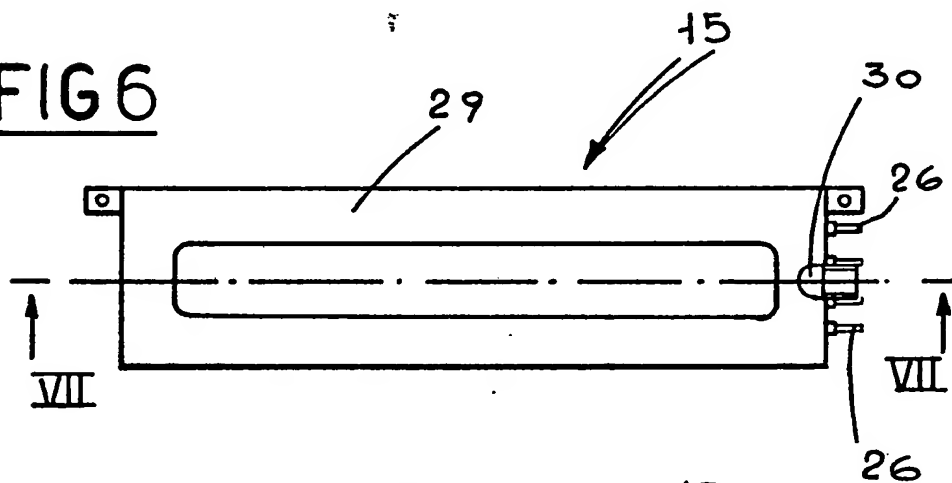
**FIG 2**



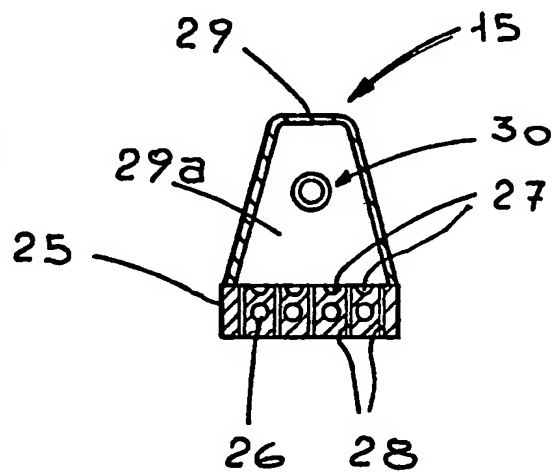
**FIG 7**



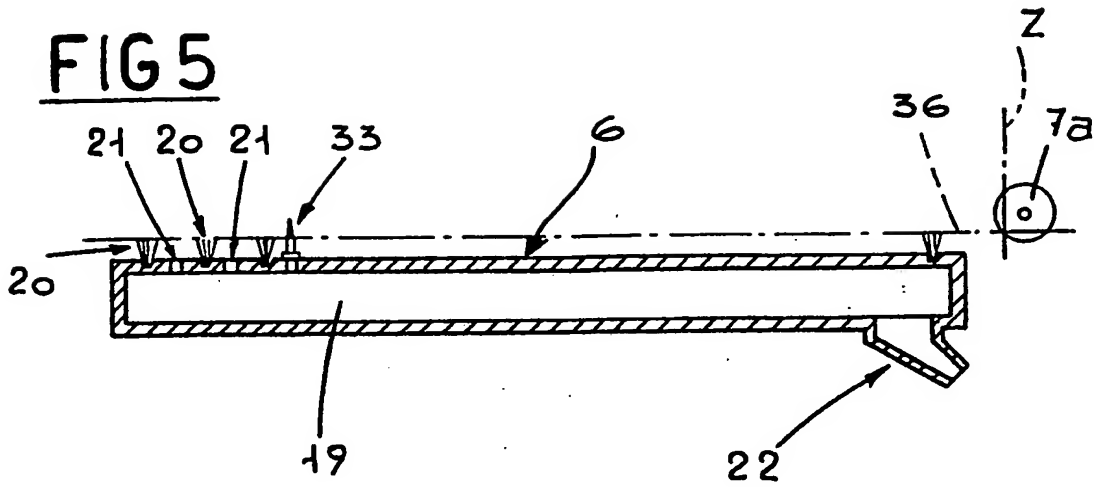
**FIG 6**



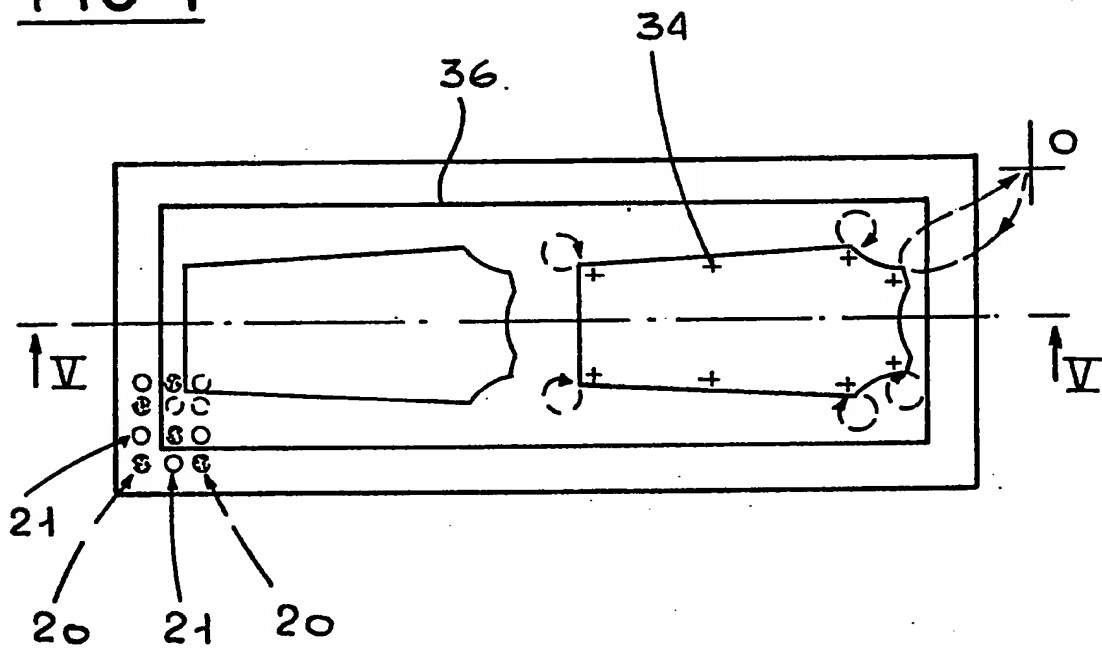
**FIG 8**



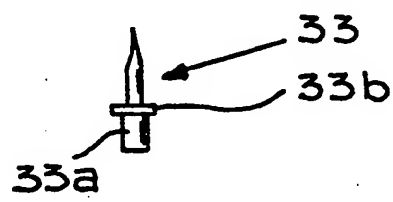
**FIG 5**



**FIG 4**



**FIG 10**



AUTOMATIC MACHINE TO STEAM AND CUT KNITTED CLOTHS

The present invention relates to an automatic machine to steam and cut knitted cloths, of the type comprising a supporting frame provided with at least a first cloth-supporting table at the top, on which table knitted cloths are spread, a steam unit to deliver steam to the cloths spread on the cloth table and cutting means to carry out cutting operations on the steamed cloths.

In greater detail, the above machine is designed to be used to perform the cutting of garments and the like from knitted cloths.

It is known that there are automatic machines adapted to spread one or more cloths on a table and cut the patterns of the parts forming a garment therefrom. However said automatic machines can be used only in the field of woven fabrics, while, on the contrary, they cannot be used in the knitting field to which the present invention refers.

In the knitting field said operations are presently carried out by machines substantially comprising (as shown in fig. 1) a single cloth-supporting table on which one or more cloths are manually spread. The cloths are then steamed lowering a plate 3 thereover which is articulated along one side of the cloth table and through which steam is caused to flow. Afterwards, once the plate 3 has been raised, a paper sheet with the outline of the patterns to be cut is disposed on the cloths and one of the operators, schematically identified at 1 and 2, carries out the cutting of the cloth following the outline marked on the paper by means of reciprocating-blade shears suitably supported by an arm.

The use of these machines is always

time-consuming since operators 1 and 2 are inactive during the steaming time and one of them goes on being inactive during the whole time the other operator carries out the cloth cutting by means of shears 4. Furthermore, owing to the presence of the steaming plate 3, both operators are obliged to act being disposed on the same side of the machine, which brings about problems when the spreading of the cloths and the cutting have to be executed, due to the remarkable width "a" of the cloth-supporting table.

The main object of the present invention is to provide a machine of the above type in which both the cutting and steaming of the cloths take place automatically in a suitable area of the machine, while the operators, in another area, are taking away the previously cut cloths and are spreading the new ones to be cut. In this way it is possible to eliminate all idle times existing in the machines of the known art.

The foregoing and still further objects which will become more apparent in the course of the present description are substantially attained by an automatic machine to steam and cut knitted cloths, characterized in that two working areas are defined on said supporting frame, one of which is designed to dispose the cloths to be cut on the cloth-supporting table while in the second area the cutting of the cloth is being carried out upon the action of cutting means, said cutting means comprising a bridge extending transversely over the cloth table and movable in a longitudinal direction with respect to the cloth table itself, a carriage movable along the bridge according to a direction at right angles to the longitudinal extension of the cloth table, a pair

of shears supported by the carriage and capable of rotating about a vertical axis at right angles to the directions of movement of the carriage and the bridge, said bridge, carriage and shears being controlled as regards their movements by respective actuators in turn uninterruptedly controlled by a numeric control unit provided with a self-teaching software capable of storing data relating to a first hand-made cutting cycle so that said cycle may be then repeated automatically.

Further features and advantages will best be understood from the detailed description of a preferred embodiment of an automatic machine to steam and cut knitted cloths in accordance with the present invention, given hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

- Fig. 1 is a perspective view schematically showing a machine to steam and cut cloths in accordance with known art;
- Fig. 2 is a schematic plan view of the machine of the invention;
- Fig. 3 is a perspective side view in split of the machine of the invention;
- Fig. 4 is a top view of one cloth-supporting table of the machine shown in Figs. 2 and 3;
- Fig. 5 is a sectional view of the cloth table taken along line V-V in Fig. 4;
- Fig. 6 is a schematic top view of the steaming unit being part of the invention;
- Fig. 7 is a sectional view of the steaming unit taken along line VII-VII of Fig. 6;
- Fig. 8 is a sectional view of the steaming unit taken along line VIII-VIII of Fig. 7;



- Fig. 9 is a perspective view of a detail showing the axes of movement of the various members designed to execute the cutting of the cloths;

- Fig. 10 is a side view of a nail designed to be positioned, together with other similar nails, on the cloth tables of the machine to fix the cloths thereto.

Referring particularly to Figs. 2 and 3, an automatic machine to steam and cut knitted cloths in accordance with the present invention has been globally identified by reference numeral 40.

The machine 40 comprises a supporting frame 41 on which two working areas are originally defined: in one working area 41a operators 1 and 2 disposed on either side of the frame carry out the spreading of the knitted cloths, referenced by 36 in Figs. 4 and 5, on a cloth-supporting table, and in a second working area 41b located consecutively to the first area 41a the cloths themselves are submitted to steaming and cutting operations.

Advantageously, provision is made for a first cloth-supporting table 5 and a second cloth-supporting table 6 disposed in coplanar relation with respect to each other and movable on the supporting frame 41 so that they can mutually change their positioning. To this end, as shown in Fig. 3, the first cloth table 5 is supported by four fluid-operated support cylinders 10 mounted on a framework 11 movable by means of wheels 12 along horizontal guides 13 fastened to the supporting frame 41. A further fluid-operated cylinder 14 fixed to the supporting frame 41 and acting on the framework 11 carries out the various movements of the first cloth table 5 from the position shown in Fig. 3 to the position which in the same figure is occupied by

the second cloth table 6. Obviously the displacements of the first cloth table 5 can be performed using a plurality of known means different from that hereinabove described.

The second cloth table 6, in turn, is slidably mounted on respective guides integral to the supporting frame 41 and can be moved, by appropriate power means, from the position shown in Fig. 3 to the position which in the same figure is occupied by cloth table 5. During said displacement the first cloth table 5 is slightly lowered with respect to the cloth table 6 upon command of the support cylinders 10, to be then brought against flush with the second cloth table when the displacement is over.

The possibility of alternating the position of the cloth-supporting tables 5 and 6 enables the operators 1 and 2 to replace the cut cloths 36 which are spread on the table located in the first working area 41a, with new cloths to be cut, while in the second working area 41b occupied by the other cloth table the steaming and cutting of other cloths 36 is being carried out.

The arrangement of cloths 36 to be cut on the cloth tables 5 and 6 is preferably accomplished using a bridge element 17 slidably guided along the supporting frame 41 and manually movable in the region of the first working area 41a. The bridge element 17 has a crosspiece 18 used as a means to facilitate the stretching of the cloths on the corresponding cloth table, 5 or 6 respectively. In addition, thanks to the crosspiece 18 it is possible to check the alignment of the knitted fabric pattern with respect to the geometry of the cloth table 5 or 6, at a glance. In fact the operators 1 and 2 must necessarily spread the knitted fabric cloth 36 by hand and the bridge element 17 which is manually

movable is just used to help a visual checking of the fabric pattern in order to avoid the cloth being disposed obliquely or in an irregular manner.

Preferably, each of the cloth tables 5 and 6 is provided with a number of brushes 20 evenly distributed on the surface on which the cloths are spread. All brushes project by an identical amount from the respective cloth table 5 or 6 and perform two functions, i.e. they keep the cloths 36 slightly raised with respect to the cloth table to facilitate the following cutting operations and prevent the cloths from accidentally moving on the cloth tables.

As clearly shown in Fig. 5, preferably each cloth table 5, 6 exhibits a box-shaped structure within which a hollow space 19 terminating in a plurality of holes 21 formed on the cloth table on which the cloths are disposed, is defined. Preferably, as shown in Fig. 4, holes 21 and brushes 20 are disposed according to a quincuncial arrangement so that they extend in all directions.

A suction hood 22 extending over the whole width of the corresponding cloth table 5, 6 joins said hollow space 19. The hood 22 of each working table 5, 6 is adapted to be connected to a coupling pipe 24 extending from an exhaustor 23 fastened to the supporting frame 41, when the corresponding table is located in the second working area 41b.

The assembly consisting of holes 21, hollow space 19, suction hood 22 and exhaustor 23 aims to cause the cloths 36 to be rapidly and uniformly crossed by steam during the steaming step without any risk of condensate being formed. In addition, at the end of steaming, exhaustor 23, if it is kept functioning quickly dries and cools the cloths.

If necessary in order to reduce the time for

drying and cooling the cloths 36 at the end of steaming, it is possible to operate a second exhauster similar to exhauster 23. Alternatively exhauster 23 can be driven by a two-speed motor, the higher speed being used for drying.

Advantageously, holes 24 can be also used to drive particular nails 33 (Fig. 10) into the cloth tables 5, 6, which nails are adapted to fasten the cloths to said tables. Each nail 33 has a cylindrical shank 33a to be housed in one of the holes 21 and provided with an abutment 33b adapted to bear against the cloth table 5 or 6, as shown in Fig. 5. A possible positioning of the nails with respect to the cloth 36 being worked has been shown by axes 34 in Fig. 4.

The steaming of cloths 36 is carried out by a steaming unit substantially comprising a steam distributor 15 connected to a boiler 16, schematically shown in Fig. 2. In the example shown the boiler 16 is located separately from the machine 40 and in the event it should be too far from the machine it would be useful to install a superheater 35 immediately upstream of the distributor 15 in order to cause the condensate which is likely to be formed in the duct connecting the boiler to the distributor to vaporize.

In an original manner, the distributor 15 extends transversely to the cloth tables 5 and 6 and is mounted slidably on the supporting frame 41 so that it is movable lengthwise of the table 5 or 6 located in the area 41b, as shown by the arrow "F1" in Fig. 2. The distributor 15 is operated according to known modalities. However it is desirable that it may vary its speed of movement depending upon requirements. In this connection it is to be noted

that the displacements of distributor 15 can be performed by a dc motor or upon command of a single-speed motor, in which case a mechanical or hydraulic speed variator is interposed therebetween.

As clearly shown in Figs. 6, 7 and 8, the distributor 15 comprises a housing 29 provided, at the lower part thereof, with a delivery plate 25 facing the cloth table 5 or 6 and having a number of delivery holes 28 homogeneously distributed thereon. The delivery holes 28 communicate with a chamber 29a formed between the housing 29 and the delivery plate 25 and into which a delivery pipe 30 runs. Said delivery pipe has one end 31 connected to the boiler 16 after interposing the superheater 35 if necessary, and as shown in Fig. 7 it thoroughly crosses the chamber 29a, its second end 31a being hermetically closed. Steam comes out of pipe 30 through holes 32 formed in the upper part thereof.

One or more heating elements 26 are also provided to be housed in the delivery plate 26 preferably made of aluminium, said heating elements having the function of causing the evaporation of the condensate which might deposit in the plate. Said condensate is preferably gathered in grooves 27 formed longitudinally in the plate 25 above the heating elements 26.

In accordance with the present invention the cutting of the cloths 36 is accomplished automatically upon the action of cutting means globally referenced by 42 in Figs. 2, 3 and 9. Said cutting means 42 originally comprises a bridge 9 extending transversely to the cloth tables 5 and 6 over the latter. Bridge, 9, slidably engaged to the supporting frame 41, is movable according to the direction "X" in Fig. 9, lengthwise of the cloth

tables 5, 6 in the region of the second working area 41b.

Slidably mounted on the bridge 9 is a carriage 8 movable along the bridge itself according to a direction "Y" at right angles to the direction of movement "X" of the bridge. The displacements of carriage 8 and bridge 9 take place for example by means of direct current motors provided with ball screws or other technically equivalent means.

Rotatably supported by carriage 8 about an axis "Z" is a pair of shears 7 provided with a rotary blade 7a operated according to a horizontal axis. As shown in Fig. 5, the axis of rotation "Z" of shears 7 must preferably pass through the meeting point between the cloth 36 and the outer circumferential edge of the blade 7a. Advantageously, since the cloth 36 is kept in a raised position by brushes 20, the blade 7a can easily carry out the cutting without its outer circumferential edge interfering with the cloth table 5 or 6.

By suitably moving shears 7 according to directions "X" and "Y" and suitably directing them around axis "Z" it is possible to make the blade 7a take any path in the whole region of the second working area 41b.

The displacements and movements of shears 7 along directions "X" and "Y" and about axis "Z" are controlled uninterruptedly by a numerical control unit, preferably of a microprocessor type, herein not described as known per se. Keyed-in in said control unit is a self-learning software which, once the manual self-learning cutting cycle has been carried out, allows the same cutting path to be automatically taken an indefinite number of times.

Operation of the machine according to the

invention described above mainly as regards structure, is as follows.

At the beginning, operators 1 and 2, with the aid of the bridge element 17 spread a cloth 36 to be cut on the cloth table 5 or 6 located in the first working area 41a. To this end, the crosspiece 18 is caused to slide under the cloth 36 which is gradually laid down on the brushes 20 of the cloth table 5 or 6 and then fastened along its edges by nails 33.

Afterwards the pattern of the garment to be cut is disposed on cloth 36. However said pattern can also be directly drawn on the cloth.

The control unit being in its self-learning state, shears 7 are manually guided so that the rotary blade 7a can go along the whole perimeter of all drawn pattern parts. At the end of this operation the control unit has stored all paths taken by the blade. An example of a path is given in dotted line in Fig. 4 in which the initial starting point of blade 7a is indicated by "0".

At this point the real production work begins. Operators 1 and 2 spread and fix the cloths 36 on the cloth table 5 which is supposed to be in the first working area 41a.

By depressing the cycle-starting pushbutton, the cloth table 5 is slightly lowered upon command of the support cylinders 10 and, being acted upon by the cylinder 14, it moves towards the second working area 41b, while at the same time the cloth table 6 moves in the opposite direction. At the end of the stroke the support cylinders 10 raise the table 5 again so that it is flush with table 6.

Operators 1 and 2 take the previously cut cloths 36 away from table 6 and arrange new cloths to be cut thereon. At the same time the steam distributor 15

is moved on table 5 and causes the cloths 36 disposed thereon to be steamed.

At the end of the return stroke of distributor 15, the cutting means 42 is operated and, upon command of the control unit, it executes the cutting of the cloths 36 according to the previously stored cycle.

When the cutting is terminated shears 7 come back to the starting point "0" and the cloth table 5 is lowered again. Tables 5 and 6 move again mutually changing their positionings and subsequently table 5 is brought again flush with table 6. Thus operators 1 and 2 can take the cut cloths 36 away from table 5 and dispose new cloths thereon.

The above described cycle is repeated continuously.

The present invention attains the intended purposes.

It is to be noted that the above description does not represent the only possible embodiment of the present invention. In fact a cutting machine according to the invention could have at least a fixed cloth table and the cutting means and steaming unit could be capable of operating according to the whole length of the supporting frame 41. In this case operators 1 and 2 would carry out the spreading of the cloths by turns in the two working areas defined by the supporting frame.



CLAIMS

1. An automatic machine to steam and cut knitted cloths, of the type comprising:

- a supporting frame provided with a least a first cloth supporting table at the top, on which table knitted cloths are spread;

- a steam unit to deliver steam to the cloths spread on the cloth table; and

- cutting means to carry out cutting operations on the steamed cloths, characterized in that two working areas are defined on said supporting frame, one of which is designed to dispose the cloths to be cut on the cloth-supporting table while in the second area the cutting of the cloth is being carried out upon the action of cutting means, said cutting means comprising:

- a bridge extending transversely over the cloth table and movable in a longitudinal direction with respect to the cloth table itself;

- a carriage movable along the bridge according to a direction at right angles to the longitudinal extension of the cloth table;

- a pair of shears supported by the carriage and capable of rotating about a vertical axis at right angles to the directions of movement of the carriage and the bridge, said bridge, carriage and shears being controlled as regards their movements by respective actuators in turn uninterruptedly controlled by a numeric control unit provided with a self-teaching software capable of storing data relating to a first hand-made cutting cycle so that said cycle may then be repeated automatically.

2. A machine according to claim 1, characterized in that said shears accomplish the

cutting of the cloths by means of a rotary blade actuated according to a horizontal axis.

3. A machine according to claim 1, characterized in that a number of brushes designed to support the cloths and keep them slightly raised with respect to the cloth-supporting table is homogeneously distributed on said cloth table.

4. A machine according to claim 1, characterized in that it comprises a first cloth table and a second cloth table which are aligned in coplanar relationship and are each disposed in the region of one of said working areas, said tables being movable on the supporting frame to mutually change their positioning so that they are submitted by turns to the spreading of the cloths and the action of the cutting means.

5. A machine according to claim 3, characterized in that at least the first cloth table is supported by fluid-operated support cylinders mounted on a framework movable along guides carried by the supporting frame to move the table from the first working area to the second working area and vice versa while the second cloth table is moved in the opposite direction, said support cylinders being arranged so that they cause the lowering of the first cloth table below the second cloth table during the movements of the tables themselves.

6. A machine according to claim 4, characterized in that each cloth table has a box-shaped structure defining a hollow space inside it which leads to a plurality of through holes formed in the upper part of the cloth table itself, to said hollow space being connected a suction hood adapted to be connected to an exhauster mounted on the supporting frame, when the corresponding cloth table

is positioned in the second working area.

7. A machine according to claim 1, characterized in that the steaming unit acts on the second working area before the intervention of the cutting means.

8. A machine according to claim 1, characterized in that said steaming unit comprises a steam distributor connected to a boiler and extending transversely to the cloth table and movable lengthwise of the table itself to distribute steam on said knitted cloths.

9. A machine according to claim 8, characterized in that said steam distributor comprises a housing provided at the lower part thereof with a delivery plate facing the cloth table and has a plurality of delivery holes homogeneously distributed and communicating with a chamber defined between the plate and the housing, in which chamber a delivery pipe communicating with said boiler runs.

10. A machine according to claim 9, characterized in that a plurality of heating elements are housed in said delivery plate to cause the evaporation of the condensate eventually formed at the inside of the distributor.

11. A machine according to claim 10, characterized in that said plate is provided with a plurality of grooves disposed above said heating elements to gather the condensate eventually formed in the distributor.

12. A machine according to claim 9, characterized in that said delivery pipe thoroughly crosses the chamber formed in said housing and has one end communicating with the boiler and a second end hermetically closed, a plurality of through holes for the distribution of steam being provided on the

upper part of said pipe.

13. A machine according to claim 1, characterized in that slidably mounted on the supporting frame in the region of the first working area, is a bridge element extending transversely to the cloth table and movable lengthwise of the latter to facilitate the spreading of the cloths thereon.

14. An automatic machine to steam and cut knitted cloths, substantially as herein described with reference to the accompanying drawings.

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